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SOIL SURVEY
OF
CLAY COUNTY, KANSAS

BY

JAMES THORP, U. S. Department of Agriculture, in Charge
and R. H. DAVIS and EUGENE S. LYONS
Kansas Agricultural Experiment Station

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By JAMES THORP, U. S. Department of Agriculture, in Charge, and R. H. DAVIS and EUGENE S. LYONS, Kansas Agricultural Experiment Station

COUNTY SURVEYED

Clay County is in the northern part of the eastern half of Kansas. The county is rectangular in shape, being 30 miles long from north to south and 22 miles wide from east to west. It includes an area of 652 square miles, or 417,280 acres.

Drainage, which is good, is mainly through Republican River. Bottom lands comprise about one-fifth of the area of the county. The larger areas, which lie along Republican River, range in width from three-fourths mile at Gatesville to 4 or more miles at Clay Center and Morganville. The bottom lands along the creeks are more or less important, those along Chapman Creek covering the largest area.

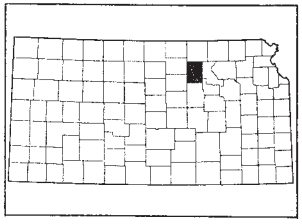

FIGURE 1.—Sketch map showing location of Clay County, Kans.

Physiographically the uplands of Clay County fall into two divisions—a dissected plain in the central, southern, and eastern parts of the county, exclusive of the river bottom, and a slightly hilly plain in the northern and western parts. The general level of the hilltops of the first division is about 1,300 feet above sea level, and that of the second is about 1,400 feet, although a few hills in Oakland Township reach an altitude of 1,500 feet. The plain of the eastern and southern parts of the county is rolling or hilly near the creeks and undulating or nearly flat on the larger watersheds. This part of the county is underlain by Permian shales and limestones, which would seem to account, in part, for the character of erosion existing here. The northern and western parts of the county are in general more rugged, owing probably to the alternating hard and soft layers of the underlying Dakota sandstone and largely to the fact that these areas are the main watersheds of this part of Kansas.

A flat terracelike area covering about 3,000 acres extends from the central part of Bloom Township to the northwestern part of Blaine Township. The soil is the same as that occurring on high levels.

The bottom lands of the county lie at two distinct terrace levels. The first-bottom land lying next to the river is subject to overflow at intervals of 10 or 12 years, but the higher terraces, which lie from 10 to 20 feet higher, are never inundated. Most of the creek bottoms are on the higher terraces, but in places along their upper courses overflows occur occasionally.

Nearly all the first-bottom lands along the river are more or less sandy. The second bottoms are chiefly silt loams, with a few sandy areas.

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Most of the first bottoms slope gently in the direction of stream flow but not directly toward the river. In most places there is a more or less well-developed natural levee, but in many places where this is lacking artificial dikes to keep out flood waters have been constructed. The second bottoms, where very wide, appear to slope toward the adjacent hills, near many of which are creek channels roughly parallel to the river. In very close proximity to the hills, however, the slope is toward the river because of the colluvial wash and thin alluvial fans spread out from the smaller draws and gullies. The elevation above sea level of these river bottoms is about 1,140 feet at Wakefield, 1,200 feet at Clay Center, and 1,260 feet at Clifton.

Clay Center, the county seat and largest town of Clay County, is near the center of the county on Republican River. It had a population of 3,715 in 1920. The population of the county declined from 15,833 in 1900 to 14,365 in 1920, probably owing to the recent movement toward the larger cities and to the introduction of labor-saving machinery on the farms.

Clay County is well served by almost 100 miles of railroad. The main line of the Chicago, Rock Island & Pacific Railway between Kansas City and Denver and a branch line of the Union Pacific Railroad cross the county from southeast to northwest. Another branch of the Union Pacific crosses the county from east to west, passing through Clay Center. A branch of the Atchison, Topeka & Sante Fe Railway crosses the southwest corner and the Missouri Pacific Railroad passes through Clifton a few feet north of the Clay County line. All parts of the county are within easy reach of a railroad.

Most of the roads of the county are very good and are nearly always in excellent condition except during and immediately after rainstorms. The main highways have been brought to grade and are kept smooth and hard. The heavy clay layer of the mature soils of this region, when properly graded and scraped, makes a road which in good weather is almost equal to concrete. When the material is wet travel is sometimes suspended for a few hours, until the mud dries somewhat. Secondary roads are usually kept in good condition by occasional grading, dragging, and scraping.

Clay Center obtains its water supply from wells dug in the river bottom. This water does not come from a great depth, but has been so thoroughly filtered by natural processes that it is pure enough for drinking purposes. The water is hard and in some of the residences and business houses water softeners have been installed. In the rural districts the people obtain their drinking water from shallow wells and their wash water from rain-water cisterns. As few creeks in the county are perennial, artificial methods of procuring water for livestock must be resorted to. On some farms dams are built across the small draws to catch and hold the run-off after rains, but on most farms windmills equipped with automatic starting and stopping apparatus are installed, with galvanized-iron or concrete tanks to catch and hold the water pumped from shallow wells.

Most sections of the county are well served by schools. High schools are in Clay Center, Wakefield, Longford, and Clifton.

Most of the farmhouses are good, and many are supplied with modern conveniences. The farm buildings are in general in good repair and adequate for most needs. On the whole, Clay County is considered one of the most prosperous counties of the State.

CLIMATE

The climate of Clay County is characterized by a comparatively long frost-free season with enough moisture to insure the maturing of crops. Although the average annual rainfall is not so high as in States farther east, its distribution is very favorable. Eighty-two per cent falls during the growing season from April to October, inclusive.

The rainfall is sufficient in most years to produce good crops. Sometimes, however, periods of drought during the maturing season prove disastrous to corn, especially if accompanied by hot winds. Thunderstorms occur at frequent intervals during the summer. Hailstorms do some damage, but they are infrequent.

The prevailing summer winds are from the south, and those of winter are from the northwest. Very strong hot winds from the south, blowing night and day for several days at a time, sometimes occur in July and August. However, in several successive seasons such winds may not occur.

The average frost-free season extends from April 26 to October 13, a period of 170 days. Killing frosts have been known to occur as late as May 27 and as early as September 20.

The hottest weather usually occurs in July and August, but the highest temperature ever recorded, 116° F., was in June. During the summer the nights, as well as the days, are apt to be very hot. Temperatures below zero have been experienced in December, January, February, and March.

Table 1, compiled from the records of the United States Weather Bureau station at Clay Center, gives data representative of climatic conditions in Clay County.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Clay Center, Kans.*

[Elevation, 1,203 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1914)	Total amount for the wettest year (1915)
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*
December	30.5	74	−14	0.81	1.20	0.22
January	27.7	74	−23	.57	.05	1.80
February	31.6	81	−35	1.12	.80	1.98
Winter	29.9	81	−35	2.50	2.05	4.00
March	43.9	93	−12	1.26	.55	2.15
April	53.9	97	9	2.64	.95	4.75
May	64.0	105	21	4.60	2.27	7.83
Spring	53.9	105	−12	8.50	3.77	14.73

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Clay Center, Kans.*—Continued

[Elevation, 1,203 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1914)	Total amount for the wettest year (1915)
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*
June	73.8	116	41	4.51	1.43	6.82
July	79.2	112	46	3.17	1.70	7.85
August	78.0	113	38	3.66	2.10	3.13
Summer	77.0	116	38	11.34	5.23	17.80
September	67.8	108	25	2.96	4.11	4.92
October	56.8	96	13	1.98	2.42	2.82
November	44.0	88	0	1.39	.00	.67
Fall	56.2	108	0	6.33	6.53	8.41
Year	54.4	116	−35	28.67	17.58	44.94

AGRICULTURE

Among the first permanent settlers in the country which is now Clay County were the Younkins brothers from Pennsylvania, who entered in April, 1856. Within a short time they were followed by settlers who took up land in various parts of the county. The drought in 1860 almost stopped immigration, and the population of the county increased very little until the close of the Civil War. Then a second era of progress opened, and many settlers entered to establish permanent homes. These pioneers found the land in the possession of the Kaw Indians, who were comparatively peaceful. However, the settlers were so alarmed by reports of depredations in adjoining counties that at times they left their homes and fled to places of safety.

The first railroad to enter the county was the Junction City & Fort Kearney (now belonging to the Union Pacific system), which was completed to Clay Center on March 12, 1873. The Kansas Central, which was at first a narrow-gauge road, was built in 1883.

Most of the first settlers selected the bottom lands for cultivation, partly because the Indians had already used these lands for agricultural purposes and partly because they considered the uplands too dry for the successful production of crops. Each homestead included 160 acres of land. Only a very few acres were broken at first to produce vegetables and grains for home use and feed for work animals. A little more land was broken each year, and more and more crops were planted as markets became available. Farms have increased in size until in 1925 the average size of farms was 206.3 acres.

Spring wheat for home consumption was first raised about 1858. About 10 years later the ravages of chinch bugs forced the farmers to plant winter wheat, which proved to be more productive and a better market grain. Oats also were successfully introduced. The

introduction of alfalfa in the early nineties proved a very important contribution to the prosperity of the county. This crop has not only increased the amount of good feed, but its use in the crop rotation has also helped maintain the productivity of the soil. Unfortunately a new disease, known as bacterial wilt of alfalfa, has made its appearance in Kansas and is doing great damage to the crop.

The crops generally raised along the valleys of the larger creeks and on the river bottoms are corn, alfalfa, wheat, oats, sorghum, and kafir. In the river valley near Clay Center and Morganville these crops are supplemented by truck crops. On the rolling uplands, where the soil is tillable, the same crops are raised as on the terraces and river bottoms, with rye, millet, Sudan grass, and prairie hay in addition. On practically all the upland farms there are small orchards which are for the most part poorly cared for and which produce hardly enough fruit for home consumption. Some fruit is also raised on the terrace soils, particularly on Waukesha silt loam. In the hilly regions of the county, where little of the soil is tillable, the land is left largely in pasture used for grazing steers. The yearlings and 2-year-olds are shipped in, fed for a time, and shipped elsewhere for finishing. Many of these pasture farms have small areas of tillable land on which feed for cattle is produced. There is a greater tendency at present toward the raising of beeves and the finishing of cattle for market.

Most of the farmers have a few dairy cattle to supply their families with milk and butter, and many depend on their dairies for a substantial part of their income. The manure produced is an important by-product for the enrichment of the land. Several agencies in Clay Center and in some of the smaller towns purchase milk, cream, butter, and eggs. One such company draws products from a radius of 200 or more miles. High prices are paid for dairy products, as in Clay County tuberculosis has been eradicated from the herds.

Most farmers derive considerable profit from the raising and fattening of hogs. The chief breeds are Duroc-Jersey and big-type Poland China. The local packing plants purchase some of the hogs, but most of them are shipped to the larger cities farther east.

Clay County ranks high in the chicken-hatching industry. Three hatcheries are located at Clay Center, three at Wakefield, and one at Broughton. The most popular breed of chickens is the White Leghorn. The poultry business is not limited to the hatching of chicks, however, as there is a very large production of eggs and fowls for food. Twenty farmers in the county keep more than 1,000 chickens each. A packing plant at Clay Center handles large quantities of eggs and dressed poultry, which are stored and shipped to the large markets with the dairy products. Considerable numbers of ducks, geese, and turkeys are also raised.

Tables 2 and 3, giving data from the Kansas State Board of Agriculture's twenty-fourth Biennial Report, 1924–25, give the acreage and production of the principal field crops in Clay County and the value of farm products in 1923 and 1924, respectively.

TABLE 2.—*Area and production of field crops in Clay County, Kans., 1923 and 1924*

Crop	1923		1924	
	Acres	*Bushels*	*Acres*	*Bushels*
Winter wheat	114,825	1,492,725	97,965	1,469,475
Corn	65,244	1,892,076	79,187	1,108,618
Oats	23,108	716,348	26,880	725,760
Rye	300	4,200	230	2,990
Barley	1,759	47,493	966	28,980
Potatoes	665	57,190	658	52,648
Sorghum for seed	305	6,405	497	8,449
Milo for grain	355	8,165	93	2,232
Kafir for grain	4,069	101,725	4,472	84,968
Feterita for grain	767	22,243	528	10,032
Alfalfa for seed	4	12		
		Gallons		*Gallons*
Sorgo for sirup			24	1,200
		Tons		*Tons*
Millet	1,501	3,573	1,384	3,045
Sorghum for hay	4,775	14,325	4,384	13,152
Milo for stover [1]		710		1,395
Milo for hay			17	34
Kafir for stover [1]		9,155		9,391
Kafir for hay	963	2,408	654	1,569
Feterita for stover [1]		1,534		845
Feterita for hay	274	548	132	264
Sudan grass	3,763	11,109	2,915	7,288
Alfalfa for hay	12,772	33,207	14,152	28,304
Sweetclover	189		476	857
Prairie hay [2]	19,836	13,003	10,872	8,698

[1] Forage after harvesting grain.
[2] Prairie grass for pasture Mar. 1, 1924, 96,794 acres.

TABLE 3.—*Acreage, value, and production of farm products, by classes, in Clay County, Kans., 1923 and 1924*

Products	1923		1924	
	Acres	*Dollars*	*Acres*	*Dollars*
Field crops	246,505	3,674,045.83	246,662	3,667,822.71
Animals sold and slaughtered		1,041,599.00		1,110,833.00
Poultry and eggs sold		309,163.00		346,671.00
	Pounds		*Pounds*	
Butter	2,188,956	863,533.51	2,100,856	894,622.36

On March 1, 1923, there were 195 silos in the county, and on March 1, 1924, 178. The number of tractors on March 1, 1923, was 389 and on March 1, 1924, 380.

One of the commonest crop rotations of this part of Kansas is corn, oats, and wheat. On many farms no rotation is practiced until the land refuses to produce successfully the crop continuously planted. Alfalfa is produced on many farms but is not generally grown in rotation with the grain crops.

The first cutting of alfalfa is made in the latter part of May. The different varieties of sorghum are used for fodder, silage, and grain. Sudan grass and millet are both used for hay, especially Sudan grass, which produces large quantities of excellent feed.

Most of the farms of Clay County are supplied with labor-saving machines, which are being used more and more to replace work animals and farm laborers. A few farms are equipped with very large tractors and 10-gang plows, but the 2-gang and single plow are far more common.

Farm help has been scarce of late years, and wages are high. This has resulted in the introduction of labor-saving machinery and a corresponding decrease in the number of farm hands.

More than half the farms of the county, 51.9 per cent, are operated by the owners, and of the 48.1 per cent operated by tenants a large proportion are run by persons related to the landlord. Such tenancy accounts in part for the prosperity of the county.

The question of maintaining and increasing the productivity of the soil is very important. Crop rotation is the best means of soil improvement. The rotation in common practice, although better than none, is probably not adequate. Alfalfa can not be used in a simple rotation, because the cost of getting a good stand is great and the crop must be cut for hay for three or four years in order to get the greatest returns. Corn does very well after alfalfa and usually follows it, but if a shorter rotation is desired sweetclover may be used. A leguminous crop, if plowed under, will not only add nitrogen to the soil but will greatly improve the tilth as well. On the uplands, therefore, a rotation of corn, oats, sweetclover, and wheat will be likely to produce good results. In addition to crop rotation frequent applications of stable manure will be valuable, not only for increasing the amount of plant food in the soil but also for improving the tilth. Straw and other crop residues should be returned to the land and plowed under instead of being burned, as is sometimes done.

For further information regarding the improvement of the soils Clay County farmers should correspond with the Kansas Agricultural College and Experiment Station at Manhattan. If there is a soil problem which the farmer can not solve he can consult the soil map accompanying this report, find out the type of soil on his farm, and then write a description of the trouble to the experiment station. If a soil sample is sent in for examination it should be very carefully taken from the ground, keeping the material of the several soil layers separate. Many soil samples sent in by farmers are of little value because they are neither well selected nor well described.

SOILS

As a result of climatic conditions which act uniformly over a given region the soils of an area no larger than Clay County are similar in certain features. In Clay County the soils developed where climatic forces have acted without interruption have dark-colored surface soils containing an accumulation of organic matter, heavy compact upper subsoil layers, and lower subsoil layers containing lime carbonate.

The soils differ considerably in color, texture, structure, and other characteristics. These differences are the result of the following agencies: (1) The character and mode of accumulation of the parent materials from which the soils have been developed; (2) the kind and intensity of the soil-forming processes to which the parent materials have been subjected; (3) the resistance to soil-making forces offered by the different kinds of material; and (4) the length of time during which the soil-forming processes have acted in any given spot. It is believed that the soil-forming processes have had a greater influence in determining the more important characteristics of the

older soils than have the parent materials. The difference in these processes is largely determined by drainage conditions. Both drainage and the age of the soil are controlled by topographic features. The soils which have reached the most advanced stage of development are those of the flat or gently rolling uplands where erosion has been progressing slowly and a supply of moisture has been available for normal soil development. On eroded areas with gentle slopes a smaller amount of rainfall enters the soil and the removal of the soil water by run-off is more rapid. On excessively eroded areas the true soils are very thin and, in places, entirely removed by rapid erosion, leaving the parent rock exposed.

The soils of Clay County may, therefore, be placed in the three following groups on the basis of their relative stage of development: (1) Soils having well-developed profiles or having the greatest possible number of layers for this climatic region and regarded as mature; (2) soils having only moderately well-developed profiles; and (3) soils in which the layers are only indistinctly developed or lacking. The soil-forming processes, including physical forces, such as the removal of material from one horizon, or layer, and its accumulation in another, and chemical changes produced by oxidation, hydration, and other processes, such as the accumulation of organic matter, tend to produce in the soil material a number of layers. When sufficient time has elapsed the greatest number of these layers possible in that climate develops. The layers differ from each other rather sharply and are well defined and distinct.

The most mature soils of the county or those which have been subjected to undisturbed development for the greatest length of time under the influence of the full normal precipitation of the region have developed a number of persistent layers. The surface layer, from 1 to 2 inches thick, is very dark grayish brown. It is either structureless or very finely granular and is loose and acts as a mulch over the surface soil. It is underlain by a very dark grayish-brown layer slightly heavier in texture than the surface layer and distinctly granular. This layer reaches a depth of about 9 inches. The next layer, which continues to an average depth of about 16 inches, is heavier in texture than the layer above and is somewhat compact. The entire soil mass is made up of well-formed granules. The next lower layer is the one of maximum compaction and is known as a claypan. It consists of dark grayish-brown or dark olive-brown silty clay loam. It breaks up into tough clods which are rather difficult to crush. The next lower layer is olive-brown heavy silty clay loam or silty clay typically having a columnar structure and breaking horizontally into roughly cubical blocks. Lime concretions are abundant, but as a rule the soil material in which the concretions occur is not highly calcareous. Lime concretions are not present in the next layer which begins below a depth of 45 inches. The material, a grayish-yellow friable silty clay loam, continues downward to the parent rock which is reached at a depth of several feet.

The profile described is developed over the smooth upland in all parts of Clay County. It is represented by the soils of the Idana and the Crete series. The Idana soils have developed on limestones and shales and the Crete soils on a silty material known as loess.

The soils on the rolling areas where erosion is moderately rapid and where various parent rocks are near the surface naturally have more variable profiles. The surface soils vary in thickness and in color. On the more gentle slopes the heavy subsoil layer occurs but is not so dense and heavy as in the Idana and Crete soils of the nearly level upland. Below the subsoil is the slightly altered parent material. Such soils are mapped in the Lancaster, Derby, Longford, and Crawford series.

The immature soils form two groups. Members of one occur on slopes where erosion has removed the surface soil almost as rapidly as it formed, and the soil is not left undisturbed long enough to allow the formation of the regional profile. In this group may be placed the Sogn soils and eroded phases of other soils. Raw immature soils of the second class occur on the flood plains of streams where the comparatively recently deposited alluvium has not developed a normal profile. The flood plains, including the Sarpy and Cass soils and river wash, are immature. In some places poor drainage has resulted in an abnormal profile. The Ladysmith soils of the poorly drained uplands and part of the Wabash soils of the bottom lands are included in this group.

The Waukesha soils have either developed on materials low in lime or have been leached of their lime. Although these soils are not immature they have been prevented, probably by local conditions, from developing the normal mature profile of the region.

The soils of Clay County have been grouped in series and types on the basis of properties that could be determined by examination or by simple field tests. The series is the broader group and may include a number of soil types. All soils of one series have certain properties and features in common. The soil type is separated solely on the basis of the texture of the surface soil and is the unit of soil mapping. Slight variations from the soil type, as usually described, are called phases.

In Clay County 19 soil types and 2 phases of types representing 13 soil series were mapped. Four classes of miscellaneous material, mainly nonagricultural, were also mapped and described. A brief description of the characteristics of the soils of each series follows.

The surface soils of members of the Idana series are very dark grayish brown and have a total thickness of about 17 inches. They are composed of three layers—a loose dustlike layer, a faintly laminated layer, and a granular layer. The upper part of the subsoil to a depth of about 30 inches is grayish-brown heavy compact silty clay loam or silty clay. The lower subsoil layer is grayish-brown or olive-brown silty clay loam containing numerous lime concretions. Below a depth of 40 inches the material becomes more friable and silty. Partly decomposed limestone or calcareous shale underlies this soil at a depth ranging from 3 to 12 or more feet. The Idana soils differ from the Crete principally in being underlain by limestones and shales instead of loess. Idana silt loam with an eroded phase is mapped.

Soils of the Waukesha series have dark grayish-brown surface soils underlain by grayish-brown or yellowish-brown heavier-textured subsoils. These soils are only moderately calcareous, as most of the

carbonates have been leached to a depth greater than 3 feet. The soils have developed on the higher terraces from transported and reworked stream deposits. In Clay County the silt loam and very fine sandy loam members of this series are mapped.

The Lancaster soils have brown or dark grayish-brown surface soils, underlain by reddish-brown heavy compact clay loam or clay subsoils. The weathered soil overlies coarse sandstone or conglomerate. Lancaster silt loam with an eroded phase and Lancaster fine sandy loam are mapped.

The surface soil common to the soils of the Crete series is about 17 inches thick, is rich in organic matter, and is very dark grayish brown or almost black. The material is friable, the upper part being loose and powdery and the lower part granular. The upper part of the subsoil, the layer of maximum compaction, is grayish-brown rather compact silty clay loam or silty clay. The lower part of the subsoil is light olive brown in color and below an average depth of about 30 inches becomes more friable and silty. Numerous lime concretions occur in this layer, which is underlain at a depth below 40 inches by the very slightly weathered parent material of grayish-yellow silt loam. Crete silt loam is mapped in Clay County.

The Derby soils have brown or dark grayish-brown surface soils, underlain by reddish-brown heavy, rather compact, silty clay loam subsoils which, in turn are underlain by calcareous gray friable silty clay loam or silt loam. In Clay County, the Derby soils have developed over yellow or reddish-yellow silty material which is supposed to have been wind laid. Derby silt loam is mapped.

The surface soils of members of the Longford series are very dark grayish brown. Between depths of 8 and 14 inches is a dark grayish-brown granular layer. The next lower layer, extending to a depth of 20 inches, is dark reddish-brown silty clay loam. Between depths of 20 and 52 inches is a dark yellowish-red heavy compact silty clay layer. The next lower layer, which continues to a depth of 70 inches, is bright yellowish-red friable clay loam. Lime and iron concretions are present throughout this layer, and fragments of sandstone occur in the lower part. The parent material is sandstone. Longford silt loam is mapped.

The 5-inch surface layer of soils of the Ladysmith series is very dark grayish brown or black, and the structure is finely laminated. A light sprinkling of gray is seen between the platy layers in the lower part. Between depths of 5 and 13 inches is a granular layer in which the structure particles are about one-eighth inch in diameter. This layer is underlain to a depth of 30 inches by the zone of maximum compaction, which consists of heavy dark-brown or black clay, the color changing with depth to dark drab or olive. This layer contains both lime and iron concretions and the material is calcareous throughout. These soils have developed over the same calcareous shales that produce the Idana soils but under conditions of more restricted drainage. Ladysmith silt loam is mapped.

Soils of the Crawford series have dark grayish-brown or dark reddish-brown surface soils overlying dark reddish-brown or brown heavy compact subsoils. These are prairie soils developed over limestone, but leaching has removed the lime to a depth of 3 or more feet. Only the silt loam member of the Crawford series is mapped.

The surface soils of members of the Sogn series range in color from very dark grayish brown to grayish brown. They are underlain by calcareous gray friable silty clay loam subsoils which are mottled with red and yellow iron stains. Limestone or calcareous shale underlies these soils, which are immature. Sogn silt loam is mapped.

The Wabash series includes soils having dark grayish-brown or black surface layers and gray or mottled subsoils. These soils are low in lime. The Wabash soils have developed over recently deposited alluvial materials. The silt loam member of the Wabash series is mapped.

The soils of the Cass series are characterized by dark grayish-brown or black surface soils underlain by gray sandy subsoils which overlie beds of sand or gravel. These soils have developed over sandy alluvial deposits. The sandy loam and silty clay loam members of the Cass series are mapped in this county.

The soils of the Hall series have very dark grayish-brown or almost black surface soils from 10 to 20 inches deep. The upper part of the subsoil is heavier in texture and in places is compact. It is underlain, at a depth of about 30 inches, by lighter-colored material. Lime occurs at a depth ranging from 36 to 48 inches. Hall silt loam and Hall silty clay occur in the county.

The soils of the Sarpy series have gray or light grayish-brown surface layers which are underlain by light-colored incoherent sandy or gravelly subsoils. These soils represent a less mature stage of weathering than the Cass soils. The very fine sandy loam, sandy loam, and loamy fine sand members of the Sarpy series are mapped.

In Table 4 the pH values of a few of the soil types are given. The determinations were made electrometrically, the hydrogen electrode being used.

TABLE 4.—*pH determinations of soils in Clay County, Kans.*

(1:2 soil-water ratio)

Sample No.	Soil type	Depth in inches	pH value	Sample No.	Soil type	Depth in inches	pH value
381710	Lancaster silt loam	0–4	7.01	381726	Longford silt loam	0–8	6.64
381711	do	4–12	6.75	381727	do	8–14	5.64
381712	do	12–20	5.83	381728	do	14–20	5.67
381713	do	24–38	6.15	381729	do	20–52	6.71
381714	do	38+	6.48	381730	do	52–70	8.38
381715	Idana silt loam	0–6	5.88	381755	Crawford silt loam	0–4	5.62
381716	do	6–10	5.44	381756	do	4–18	5.39
381717	do	10–30	5.94	381757	do	18–26	6.00
381718	do	30–36	7.14	381758	do	26–60	6.63
381719	do	36–48	7.99	381759	do	60–80	6.80

In the climatic region in which Clay County is situated there are many slick spots, locally called "alkali spots" in which the soil is radically different from that of surrounding areas. These spots occur in every type of soil mapped in the county but are more numerous in the uplands than on the terraces or first bottoms of the rivers. Most of the slick spots are on slopes in places where the degree of slope changes, but a large proportion is along the edges of draws,

gullies, or streams. A description of a typical slick spot within an area of Lancaster silt loam near the town of Longford follows.

The surface soil is almost identical with the surface soil of typical Lancaster silt loam surrounding it. To a depth of about 6 inches the material is light grayish-brown laminated silt loam. Between depths of 6 and 14 inches is granular and columnar reddish-brown silty clay loam. The columns, which are from 1 to 2 inches in diameter, are very distinct. This layer when dry is very hard and compact, it being impossible to crush the lumps with the fingers. Between depths of 14 and 48 inches mottled and splotched yellow, red, and gray silt loam or very compact light silty clay loam occurs. At a depth of about 24 inches deposits of lime are present, and many pockets of gypsum occur at and below this depth. The sample described was examined when the soil was very dry; when the same sample was wet the hard dry layers became very sticky and plastic.

The physical conditions of slick spots within areas of other soils are similar to those described. The color of the material varies according to the surrounding soil type. These spots are apparently caused by the natural processes responsible for the formation of the very heavy layer characteristic of the mature soils in this general region. In some places, most commonly on the steeper slopes, the ground water seeps to or near the surface. Here evaporation is apt to keep pace with seepage and salts are deposited at or near the surface. Where conditions are extreme and large quantities of salts are deposited, the area becomes unproductive. As most of these spots are too small to separate on a small-scale map they have been included with the normal soils. They are most numerous in areas of the eroded phase of Lancaster silt loam but are very common in all the upland soils except the Ladysmith. Most of the so-called "gumbo spots" owe, at least in part, their intractability to alkali salts.

In the following pages of this report the soils of Clay County are described in detail and their agricultural importance is discussed; the accompanying soil map shows their distribution; and Table 5 gives their acreage and proportionate extent.

TABLE 5.—*Acreage and proportionate extent of the soils mapped in Clay County, Kans.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Idana silt loam	142,272	37.1	Hall silt loam	7,872	1.9
Eroded phase	12,608		Hall silty clay	640	.2
Waukesha silt loam	28,992	7.0	Wabash silt loam	10,240	2.4
Waukesha very fine sandy loam	5,056	1.2	Cass sandy loam	960	.2
Sarpy very fine sandy loam	13,888	3.3	Cass silty clay loam	2,752	.7
Sarpy sandy loam	768	.2	Sogn silt loam	31,040	7.4
Sarpy loamy fine sand	4,352	1.0	Ladysmith silt loam	2,752	.7
Lancaster silt loam	34,496	10.7	Rough stony land	34,112	8.2
Eroded phase	9,856		Meadow	19,200	4.6
Lancaster fine sandy loam	3,776	.9	Dune sand	3,200	.8
Crete silt loam	7,680	1.8	River wash	896	.2
Derby silt loam	28,096	6.7			
Longford silt loam	7,040	1.7	Total	417,280	
Crawford silt loam	4,736	1.1			

IDANA SILT LOAM

Idana silt loam, which is representative of the normally developed soils of this climatic belt, is the most extensive soil in Clay County. It occupies the smooth flat or gently rolling uplands and dominates the agriculture of the county.

In virgin areas of Idana silt loam the dark-colored friable surface soil is composed of three layers having a total thickness of about 17 inches. The upper layer to a depth of 1 or 2 inches consists of loose dustlike or finely granular silt loam. The granules are one-sixteenth inch or less in diameter, but loose silt is commonly present between the grains. The color is very dark grayish brown when the soil is dry and almost black when it is wet. When the land is plowed this layer is destroyed and the material is mixed with the underlying layer. The next lower layer, which reaches a depth of about 9 inches, is very dark grayish-brown granular heavy silt loam similar in color to or slightly lighter than the surface layer. The granules range in diameter from one-eighth to one-fourth inch. They are well formed and constitute all the soil material of the layer. They are not distinguishable when the soil is wet. The material crumbles readily and is easily brought into good tilth when not too wet. When the material in virgin areas is carefully examined, it is found to have a platy or laminated structure but this arrangement is readily broken into a mass of small granules. This layer is underlain by a dark grayish-brown heavy silt loam or silty clay loam layer which continues to an average depth of about 15 inches. The granules are somewhat finer than in the layer above and are well formed. The color of the broken surface of the granules appears very slightly lighter than in the layer above, but if the granules are crushed the resulting powder is much lighter, being grayish brown. This shows that the dark color is caused by a dark organic coating on the surfaces of the granules.

The upper subsoil layer, which continues to a depth of about 30 inches, is indistinctly columnar silty clay loam or silty clay. The color is dark grayish brown in the upper part, changing to grayish brown in the lower part. The material is compact when undisturbed but when broken up forms tough clods that are pulverized with difficulty. This layer, which is the heaviest in this soil, is characteristic of mature soils in this climatic belt. The lower subsoil layer is grayish-brown or olive-brown silty clay loam less compact than the layer above. At intervals dark tongues and streaks penetrate downward into this layer, and numerous small nearly round lime concretions about one-fourth inch in diameter are present. As a rule the soil material surrounding the concretions is not highly calcareous, but the total amount of lime is rather high. Below a depth of about 40 inches the material gradually becomes more friable and silty, and the color is light olive brown. Lime concretions are not present, but iron concretions and iron stains become abundant. This is the less altered parent material and varies with the character of the original rock. Partly decomposed limestone is found in many places at a depth ranging from 3 to 6 feet below the surface, but on level and deeply weathered areas the rock may be 12 or more feet below the surface.

Areas mapped as Idana silt loam probably include small areas of the adjacent soils, which grade almost imperceptibly into the Idana soil.

The largest areas of this soil are east and north of Clay Center, in the south-central part of the county, and in Bloom and Mulberry Townships. Tracts, where most typically developed, are undulating or gently rolling but in eroded areas much of the soil is hilly. Most of it lies at an altitude ranging from 1,250 to 1,450 feet above sea level.

Drainage is practically perfect. It is effected by a dendritic network of small draws which unite and form larger streams which, in turn, flow into the creeks and rivers. Sometimes considerable damage is done by the heavy thundershowers which occur in the summer. In many places large gullies are formed, and the compact subsoil is exposed. Such erosion may be prevented or at least checked by leaving the steep slopes in prairie grass or by keeping a crop on the land as much of the time as possible. Some of the soil washed off during the rains is redeposited on the lower slopes which are thereby made more productive, but a large proportion of the material is irretrievably lost from this county in the river floods.

The few remaining virgin areas of Idana silt loam are covered by a growth of bluestem with a smaller proportion of buffalo and grama grasses. The last-named grasses predominate where the land has been extensively grazed.

Idana silt loam is well suited to a large variety of farm crops. Wheat, corn, and oats are the main crops. Many farmers are increasing the acreage of kafir and sorghum because these crops are drought resistant and provide excellent feed. In addition to the crops mentioned alfalfa, rye, millet, and Sudan grass occupy considerable acreages. Winter wheat yields range from 10 to 30 bushels to the acre, and oats average 25 bushels. Much better yields are reported when conditions are most favorable. Corn is a less certain crop than kafir, owing to hot dry winds occurring when the ears are just beginning to form. From 15 to 40 bushels may be raised, dependent on weather conditions, insect pests, and cultural methods. Alfalfa yields from 1 to 3 tons of hay to the acre, depending on the season. Sudan grass, which is grown on a small acreage, produces a large quantity of good hay. The yields vary considerably according to the nature of the soil and the quality of seed used. Prairie hay is harvested in a few places and yields about three-fourths ton to the acre.

In reclaiming eroded areas it is recommended that the ground be kept covered by some perennial grass, sweetclover, or alfalfa. If an attempt is made to cultivate the eroded areas the land should be terraced and left in small grains and sod crops as much of the time as possible. The application of barnyard manure will help restore organic material to these eroded areas and improve the hay crop thereon.

Idana silt loam, eroded phase.—On valley slopes, particularly about the heads of streams, the dark-colored surface soil of Idana silt loam is thinner and in many places somewhat lighter in color than in the typical soil. The thickness of the surface soil over the greater part of the slope areas ranges from 4 to 17 inches. In small

areas, locally known as "gumbo," this layer is completely removed and the heavy, compact layer is exposed. Here the land is very difficult to handle.

On slopes where the dark-colored surface soil is best developed the three typical layers are present but are thinner than on the smoother areas. In places where erosion has been more severe the surface soil is lighter colored, ranging from dark grayish brown to very dark grayish brown. The heavy layer or claypan has not developed on the slopes where good drainage conditions have prevailed.

The eroded phase of Idana silt loam occurs in a number of small areas in the southeastern part of the county. Other areas are in the northern and central parts bordering areas of typical Idana silt loam. Owing to the looseness of Idana silt loam and the practice of leaving large areas bare and exposed to erosion, areas of the eroded phase are increasing rapidly at the expense of the typical soil. On a number of farms erosion is being checked by a covering of alfalfa, Sudan grass, cane, and other forage crops.

Crop yields on this eroded soil vary, in some places being equal to those obtained on the typical soil and in the most severely eroded areas practically nothing.

In Table 6 are given the results of mechanical analyses of samples of the surface soil, the subsurface soil, and several layers of the subsoil of typical Idana silt loam.

TABLE 6.—*Mechanical analyses of Idana silt loam*[1]

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
381715	Surface soil, 0 to 6 inches	0.0	0.2	0.2	0.7	5.8	64.0	29.1
381716	Subsurface soil, 6 to 10 inches	.0	.1	.2	.7	5.0	58.4	35.6
381717	Subsoil, 10 to 30 inches	.1	.2	.2	.7	3.0	43.9	51.9
381718	Subsoil, 30 to 36 inches	.0	.3	.2	.5	2.9	47.4	48.7
381719	Subsoil, 36 to 48 inches	.3	.3	.1	.3	2.5	53.4	43.0

[1] After treatment with hydrogen peroxide.

WAUKESHA SILT LOAM

The 12-inch surface soil of Waukesha silt loam consists of very dark grayish-brown silt loam, containing in places a small proportion of very fine sand. This layer is laminated and breaks into small flattened grains. In some places between the laminae is a thin sprinkling of fine gray silt particles. Many wormholes and worm casts are found in the surface soil. Between depths of 12 and 20 inches the color of the soil material is very dark grayish brown or almost black, and the texture is about the same as that of the surface soil. This layer is distinctly laminated and many gray silt particles are present between the laminae. The layer breaks up into flaky grains. It gives way abruptly to dark grayish-brown silt loam which becomes slightly lighter in color when crushed and breaks into subangular or angular medium-sized granules which readily fall apart when a dry sample is examined. This layer also contains many wormholes and worm casts. The material stands up in columns which are very similar in appearance to those in Derby silt loam. The color becomes gradually

lighter with depth until at a depth of 34 inches it is grayish yellow or olive brown. Below this depth and continuing to a depth of 7 feet the columns consist of grayish-yellow silt loam stained dark brown in places by streaks of organic matter. The numerous wormholes present give the material a porous structure. At a depth ranging from 2 to 7 feet interbedded strata of various-textured alluvial material are found in many places. In most of these strata the material is fine textured, fine sandy loam being the coarsest material. These strata generally occur at slighter depth near the stream courses than they do farther away from the streams.

Waukesha silt loam occupies terraces along Republican River and along the valleys of the larger creeks. Areas are flat, with practically no relief in most places. However, the land usually slopes almost imperceptibly toward the stream and thus affords sufficient drainage. Near the hills the slopes are more pronounced, and the relief is varied by numerous alluvial fans which extend out from the mouths of the draws which drain the adjacent uplands. In such places the soil is deeper and differs somewhat from typical, but its economic value is practically the same as of the Waukesha soil. On a high terrace in the northwestern part of the county, just south of Republican River, the soil in some respects, particularly in profile development, resembles Crete silt loam but was included with Waukesha silt loam because it lies on a very distinct terrace and has about the same agricultural value. In the larger areas of Waukesha silt loam abandoned watercourses in which water sometimes stands for a short time after heavy rains are found. Most of these old stream courses are so indistinct that they do not interfere with cultivation.

Waukesha silt loam is considered by the farmers to be one of the most valuable soils of the county. It is smooth, has sufficient drainage, is reasonably drought resistant, and usually produces excellent yields of corn and alfalfa. These are the principal crops, and small grain and some other crops are also produced. Because of its high value for cultivated crops very little of this land has been left in pasture. Small apple and peach orchards are proving successful on many farms. The average yields of corn, alfalfa, and other crops are probably 10 or 12 per cent greater than on Idana silt loam.

Slick spots occur here and there in areas of Waukesha silt loam.

WAUKESHA VERY FINE SANDY LOAM

Waukesha very fine sandy loam is not a very extensive soil in Clay County. The surface layer is dark grayish-brown very fine sandy loam which breaks into fine rounded granules showing incipient lamination. Many wormholes and worm casts occur throughout this layer. At a depth of 9 inches the soil material becomes finely granular, columnar, and of a grayish-brown color. It breaks horizontally into small blocks. This layer also contains many wormholes and worm casts. Between depths of 12 and 30 inches the texture remains the same as in the material above but the color becomes reddish yellow. There is a slight admixture of fine sand in this layer, and dark-gray organic streaks occur along the cracks and wormholes. The material is compact when dry but friable when

wet. Below a depth of 40 inches is a layer of grayish-brown, slightly tinged with red, loamy fine sand which is slightly calcareous in places. In the neighborhood of Morganville, Waukesha very fine sandy loam has a subsoil almost exactly like that of Waukesha silt loam. This similarity in the subsoil is owing to the fact that it is developed from the same kind of alluvial material.

Waukesha very fine sandy loam, as mapped, includes small areas of Waukesha silt loam and Wabash silt loam and a considerable total area of Waukesha fine sandy loam. The largest areas of Waukesha fine sandy loam lie from 1 to 3 miles south of Morganville, on the east side of the river, and along some of the creek bottoms in Chapman Township.

This soil occupies a position similar to that of the silt loam except that it occurs near the edge of the first bottoms. It has a gently undulating relief, owing to the fact that the loose surface soil has been and is still being shifted by the winds. Waukesha very fine sandy loam lies from 10 to 20 feet above the neighboring first-bottom soils.

Yields of crops on Waukesha very fine sandy loam probably average lower, over a period of years, than on Waukesha silt loam. The soil is very well suited to the production of truck crops, but as yet very little of it is used for this purpose. The nearness of the sandy first-bottom soils, which are better suited to truck crops, makes it improbable that this soil will ever be used very extensively for trucking. The principal crops are wheat, corn, and alfalfa.

SARPY VERY FINE SANDY LOAM

The 10-inch surface layer of Sarpy very fine sandy loam is light grayish-brown very fine sandy loam which becomes lighter in color with depth. This soil is structureless throughout, but the presence of small worm casts gives an appearance of a finely granular structure. Between depths of 10 and 18 inches the material is pale-yellow very fine sandy loam streaked with very pale gray. There are some wormholes in this layer and a few worm casts. Below this layer and continuing to a depth of 40 inches is brownish-yellow fine sandy loam tinged with gray organic matter. This layer is somewhat calcareous in places. Underlying it is very pale grayish-yellow highly calcareous very fine sandy loam somewhat streaked with darker-gray organic material and faintly mottled with reddish-yellow iron stains. Some small areas of Sarpy silt loam and Sarpy fine sandy loam are included in mapping.

Sarpy very fine sandy loam lies on the higher parts of the first bottoms about 10 feet above the normal level of the water in the river. In many places it borders the terraces or uplands and in other places the river banks. It is well drained when the river is at its normal level, but it has sufficient capillarity to hold moisture over long periods of drought. During periods of very high water, which occur about once in 10 years, this soil is subject to overflow. At such times crops are likely to be ruined, and in some places where areas lie in the bend of the river there is danger of the soil either being washed away or of undesirable material being washed upon it.

In several places in the county many acres of good land have been permanently damaged in this way. By far the larger part of the Sarpy very fine sandy loam, however, remains in good condition.

This soil equals Waukesha silt loam in productivity and even excels that soil during some seasons. It produces fine corn and alfalfa and is frequently sown to small grains with good returns. Corn yields as high as 100 bushels to the acre in some seasons, but 50 bushels is a more common yield. Occasionally the crop is a failure on account of chinch bugs or drought. The soil works up readily and is easily kept clean of weeds. Truck crops, including several varieties of melons, are sometimes raised, but most farmers prefer to use the more sandy soils for such crops.

SARPY SANDY LOAM

The soil mapped as Sarpy sandy loam consists of Sarpy very fine sandy loam which has been covered, during floods, by a foot or two of sandy loam or loamy sand. The surface soil in most places consists of brown structureless sandy loam or loamy sand about 10 inches thick. Beneath this layer is mixed red, yellow, and white sand, containing lumps of brown sandy loam. The layers below this are similar in all respects to Sarpy very fine sandy loam.

Sarpy sandy loam lies in the bends of Republican River where the current cuts across during high water. It is likely to be changed in texture and topography with each high-water period. At present the relief is gently undulating. This soil is used for the production of corn, melons, sweetpotatoes, and other truck crops.

SARPY LOAMY FINE SAND

Sarpy loamy fine sand varies so greatly from place to place that a description of one sample is entirely inadequate to represent the soil as a whole. Therefore, a sample is described and a brief description of some of the variations is given. The surface soil of the sample consists of about 12 inches of light grayish-brown loamy fine sand, containing a noticeable amount of medium sand. Beneath this and continuing to a depth of 4 or more feet is pale-yellow fine quartz sand flecked with red sand grains and containing a few gray organic-matter streaks. At a depth of about 3 feet, the soil material is slightly calcareous. The surface soil may vary in texture from coarse sand to fine sandy loam. In many places in the subsoil thin layers of dark-brown or black materials of various textures are present.

Sarpy loamy fine sand has a hummocky relief. Very narrow strips of dark soil occur between the sandy ridges. Where these areas, which are more subject to overflow than is Sarpy very fine sandy loam, were of any considerable size they were separated on the map.

This soil is used in the production of corn, sweetclover, truck crops, and a few other crops. Perhaps 40 per cent of it is left in pasture. In some places there is a sturdy growth of cottonwood trees. Corn occasionally yields as high as 50 or 60 bushels to the acre, but the average yield is much less. Sweetclover does very well and is grown to a considerable extent. Probably more truck crops are grown on this than on any other soil in the county, and truck

growing could profitably be extended. Many watermelons and cantaloupes are produced. In a few places this soil, as well as Sarpy very fine sandy loam, has successfully been put under irrigation by pumping water from the river.

LANCASTER SILT LOAM

The surface layer of Lancaster silt loam to an average depth of 4 inches is grayish-brown or dark grayish-brown silt loam consisting of granules of all sizes up to one-fourth inch in diameter, together with some fine loose silt. This layer is underlain by dark grayish-brown granular silt loam which differs from the surface layer principally in its lighter color. At an average depth of about 12 inches rather compact dark reddish-brown clay loam begins. This material breaks up into various-sized coarse angular structure particles, most of which range from one-fourth to one-half inch in diameter. This layer continues to a depth of 38 inches, gradually growing lighter in color and more friable in consistence. It commonly contains fragments of dark reddish-brown sandstone. Below a depth of about 38 inches is reddish-yellow very friable sandy clay mottled with yellow. Many ironstone pebbles or fragments of ironstone rock occur from this depth downward. The soil throughout shows a tendency to form columns, which are not generally so strongly developed as in the Derby or Waukesha soils. In many places the subsoil is very yellow instead of red.

Areas of Lancaster silt loam are generally sloping, but in some places the hills are steep. The soil is derived in part from the Dakota sandstone which covers a large proportion of the western part of the county and a smaller portion of the northern part. A part of the parent rock is conglomerate, made up of a mixture of fine and coarse sediments. Probably one-half or more of the Lancaster silt loam is derived from material which has weathered from the sandstone beds and been carried to the lower slopes and valleys.

Drainage ranges from good to excessive. However, the water-holding capacity is better than in the Idana soils.

Lancaster silt loam is used in the production of corn, kafir, wheat, oats, rye, sorghum, alfalfa, and a few other crops. Virgin areas support a natural growth of big and little bluestem and of grama and buffalo grasses. The soil is not so fertile as Idana silt loam, and the crop yields average less. Alfalfa is extensively grown with satisfactory results. A fair average yield for this crop is about 2 tons to the acre. Since there is comparatively little organic material present, the soil loses its strength in a comparatively few years. Crop rotations and applications of manure are necessary to keep up the fertility. The soil erodes easily.

Lancaster silt loam, eroded phase.—Lancaster silt loam, eroded phase, is found in localities where the Dakota sandstone underlies the hills. In Clay County most of it occurs around the steep draws and valleys. It consists of a mixture of Lancaster silt loam, Lancaster fine sandy loam, occasionally a little eroded Sogn silt loam, and a few other soils which occur in such small areas that separation on the map is unwarranted. More slick spots occur in this soil than in any other in the county.

The land is generally rather badly broken up by gullies, and the surface soil has been partly or entirely washed away from the smoother areas. This eroded condition has been caused mainly by cultivation of the steep areas, but some virgin soil is sufficiently eroded to be classed with this phase. The crops produced are similar to those on typical Lancaster silt loam, but the yields are generally very poor. Farmers are reclaiming some of this soil by building earth dams across the gullies to catch the sediment brought down during wet spells. It would seem best to continue this practice in order to get the land back to pasture as soon as possible.

Table 7 shows the results of mechanical analyses of samples of the surface soil, subsurface soil, and several layers of the subsoil of typical Lancaster silt loam.

TABLE 7.—*Mechanical analyses of Lancaster silt loam*[1]

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
381710	Surface soil, 0 to 4 inches	0.1	1.9	5.1	8.4	11.2	52.2	21.2
381711	Subsurface soil, 4 to 12 inches	.5	2.3	7.4	9.7	8.7	44.3	27.1
381712	Subsoil, 12 to 20 inches	.6	2.9	10.1	11.0	7.0	31.8	36.5
381713	Subsoil, 24 to 38 inches	1.3	4.7	13.7	15.2	7.4	29.0	28.6
381714	Subsoil, 38 inches	1.8	7.0	23.9	22.1	9.8	19.9	15.5

[1] After treatment with hydrogen peroxide.

LANCASTER FINE SANDY LOAM

The surface layer of Lancaster fine sandy loam consists of dark brownish-gray fine sandy loam which is finely granular in structure, the granules being round. Many wormholes and worm casts occur in this layer. At a depth of about 6 inches the soil grades into dark reddish-brown fine sandy loam having a fine granular structure, the granules being subangular. This layer also contains many wormholes and worm casts. It extends to a depth of 10 inches, where another change in color takes place. Between depths of 10 and 15 inches the fine sandy clay is light reddish brown in color and finely granular in structure. In position the soil appears to be slightly mottled with brown and reddish yellow. The wormholes and worm casts persist as in the layer above. This is the most compact layer of the soil but is fairly friable. Between depths of 15 and 40 or more inches is yellowish-red sandy clay, mottled with yellow, red, and white. This layer contains fragments of sandstone and grades into the sandstone rock beneath. The entire soil is columnar in form. Slick spots are common.

Areas of Lancaster fine sandy loam are gently rolling or hilly, and natural drainage is good. Although inextensive in Clay County, the soil is widely distributed.

In places where the slope is gentle enough to allow cultivation, this soil is nearly or quite as productive as Lancaster silt loam, but at present more than half of it remains in pasture. It is important in some localities because it is the only tillable soil on certain farms. Corn, kafir, sorghum, and alfalfa are the main crops, but small

grains are grown by some farmers. The yields obtained are about equal to or slightly less than those on Lancaster silt loam. Few farms, if any, consist entirely of Lancaster fine sandy loam.

CRETE SILT LOAM

Crete silt loam occurs in the belt of loessial material bordering the valleys of Republican River and the larger creeks.

To a depth of 10 inches the material is dark grayish-brown silt loam which breaks into fine rounded and somewhat flattened granules. The layer is laminated, and fine gray silt particles occur between the laminae. Between depths of 10 and 15 inches there is no change in texture, but the color becomes more brown, the lamination decreases, and the grains become more angular and less flattened. The next layer is moderately heavy, strongly columnar, silty clay loam, which breaks up readily into fine or medium-sized dark grayish-brown angular particles increasing in size with depth. The clay breakage planes are stained with dark-brown or dark brownish-gray organic material. At a depth of 25 inches this layer gives way rather abruptly to the heaviest and most compact layer of the soil. This layer, which is about 5 inches thick, consists of olive-brown or yellowish-brown moderately heavy and compact silty clay loam, columnar in form and breaking into small angular clods. The cleavage planes are stained with dark-brown or black organic material. Grass roots do not penetrate this layer readily but follow the clay cleavage planes.

Between depths of 30 and 50 inches is light friable structureless silty clay loam which is predominately yellow in color but which in cracks and crevices is stained with brown or dark-brown organic matter. This layer contains many rounded and subangular lime concretions, one-fourth inch or less in diameter. The material is made up of indistinct vertical columns which break into irregular blocks about one-half or three-fourths inch in diameter. The organic-matter stains become fewer below this depth, and lime concretions disappear at a depth ranging from 4 to 5 feet. Below this depth is practically unaltered grayish-yellow friable silt. In many places the parent material lying at the greater depths has a more reddish color and is mottled with gray silt. Throughout the soil are many worm and insect burrows, many of which are lined with dark organic material. Plant roots follow the columns downward and branch out along the planes of clay cleavage.

Crete silt loam occupies the flat or gently undulating uplands adjacent to the river bottoms. It lies a little lower than most of the Idana soils but is from about 50 to 80 feet above the bottom lands. On slopes the Derby soils lie between this soil and the bottoms, and on the inland side it grades into the Idana soils. The slightly undulating relief affords sufficient drainage. Owing to its position this soil is nowhere seriously eroded.

Crete silt loam is rich in organic matter, easily tilled, reasonably resistant to drought, and seldom seriously eroded. It produces good yields of practically all staple crops. It is superior to the Idana soils in crop production. Alfalfa and corn do especially well, but good yields of other staple crops are obtained. This is probably the best upland soil in the county.

DERBY SILT LOAM

The surface soil of Derby silt loam to a depth of approximately 9 inches consists of very finely granular dark grayish-brown or slightly reddish very dark-brown friable silt loam. Where exposed in banks or road cuts the entire soil, together with the underlying parent material, stands erect in columns approximately 6 inches in diameter. These columns break horizontally about every 3 inches. In the surface layer there is a tendency to lamination, less pronounced than in Idana silt loam. Between 9 and 18 inches is a friable dark-brown or dark reddish-brown silt loam layer which forms columns as described. In this layer there is a tendency to granulation, but the granules are not so clearly defined as in Crete silt loam. Between depths of 18 and 50 inches a moderately friable or somewhat plastic silty clay loam layer occurs. It is coarsely granular in structure and reddish yellow in color, appearing brownish yellow along cleavage planes. At a depth ranging from 40 to 50 inches gray streaks and lime accumulations make the soil sweet and favor the production of certain crops. Between depths of 50 inches and 6 feet is the parent material consisting of brownish-yellow calcareous friable silty clay loam mottled with light gray.

Typical areas of this soil occur in the neighborhood of the Country Club south of Clay Center. Locally the parent material is more predominately yellow than typical. In many places in cuts 30 or 40 feet deep it stands up in vertical columns, as is characteristic of loessial material. Mapped areas include small areas of Idana, Crawford, and Crete soils, and of rough stony land. In Republican Township east of Republican River an area of Derby fine sandy loam comprising about 1 square mile is included.

Most of the Derby silt loam lies on the broken lands adjacent to the river and creek bottoms, and areas are generally rolling. In a few rather large almost flat areas the darker surface soil is deeper and the land is likely to be more productive. Included in most mapped areas is a small proportion of an eroded phase, but the areas were so small that separation was not warranted. The rolling relief might lead to the supposition that this soil is droughty, but owing to its friable consistence good root development is allowed and plants can make use of water throughout a good depth of soil. During the past season (1926) corn on Derby silt loam remained green and luxuriant more than a week after most of the corn on adjacent areas of Idana silt loam had been utterly ruined by hot winds. Steeply sloping areas of Derby silt loam are more subject to drought than the flat or gently sloping areas.

The same crops are produced on Derby silt loam as on the Crawford and Crete soils, alfalfa and corn being the chief crops. Yields obtained are usually only slightly less than on Crete silt loam. About 20 per cent of the more steeply sloping land is still in pasture. Leaving the land in pasture will prevent the formation of deep gullies.

LONGFORD SILT LOAM

Longford silt loam is an upland soil which is underlain by the Dakota sandstone formation. It is evidently much older than the

soils of the Lancaster series. An examination shows it to have reached the same stage of development as Idana silt loam.

The surface layer of Longford silt loam, to a depth of 8 inches, is very dark grayish-brown or nearly black distinctly laminated silt loam in which the thin plates break into small flattened grains. There is nearly everywhere a sprinkling of gray silt particles between the laminae. Numerous wormholes and worm casts are present in this layer, but they are not so plentiful as in the layer below. Between depths of 8 and 14 inches the material is dark grayish-brown silt loam with a subangular granular structure. Between depths of 14 and 20 inches the color becomes dark reddish brown and the texture heavier than in the layer above, being silty clay loam. This layer is made up of medium small sharply angular particles which fall apart readily. Many dark-colored organic-matter stains are noticeable in the clay cleavage planes and on the walls of the worm burrows. Below this layer and continuing to a depth of 52 inches is very heavy compact silty clay, which when moist is of a chocolate-brown color but when dry is dark yellowish red. These colors appear considerably lighter when the soil is crushed. The layer breaks into large irregular clods, the surfaces of which are stained with dark organic matter. The stains diminish with depth. This layer also has a tendency to form large rough columns. The next lower layer, which reaches a depth of 70 inches, is bright yellowish-red friable clay loam containing some dark organic stains and many small rounded silty lime concretions and a few black iron concretions about one-fourth inch in diameter. Small fragments of sandstone are scattered through the lower layers.

The surface relief of Longford silt loam is very similar to that of Idana silt loam, being slightly undulating or gently rolling. There are a few very small areas of hilly land, on which the surface soil erodes rather severely, leaving the heavy subsoil exposed and giving rise to the locally termed "red gumbo" land. Some spots are at present almost worthless agriculturally. Some farmers claim that the physical condition of these spots can be improved by the application of manure, but it would probably be most practical to seed the eroded spots to pasture grasses.

Longford silt loam is not an important soil either areally or agriculturally. It appears to be a remnant of what was once a far more extensive soil, which has been largely removed and replaced by soil of more recent formation. It is used in the production of small grains, corn, sorghum, kafir, and Sudan grass and for pasture. This soil is somewhat less productive than Idana silt loam, although under favorable conditions it produces equally good crops. In some places excellent results have been obtained with alfalfa. As the soil is generally sweet it is fairly easy to obtain a good stand of alfalfa.

Table 8 shows the results of mechanical analyses of samples of the surface soil, the subsurface soil, and the subsoil of Longford silt loam.

TABLE 8.—*Mechanical analyses of Longford silt loam*[1]

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
381726	Surface soil, 0 to 8 inches	0.1	0.4	1.4	3.5	11.3	58.1	25.2
381727	Subsurface soil, 8 to 14 inches	0	.3	1.0	2.6	7.5	53.2	35.2
381728	Subsoil, 14 to 20 inches	0	.3	.9	2.3	5.9	47.1	43.4
381729	Subsoil, 20 to 52 inches	0	.3	1.2	3.2	8.3	47.2	39.8
381730	Subsoil, 52 to 70 inches	.2	.3	1.4	4.0	10.7	45.8	37.7

[1] After treatment with hydrogen peroxide.

CRAWFORD SILT LOAM

The 4-inch surface layer of Crawford silt loam consists of dark grayish-brown laminated and friable silt loam. The laminae break into thin small flakes or flattened grains which show a slight sprinkling of gray silt particles. Below this layer and continuing to a depth of 18 inches the material has a more brownish tinge than the layer above, but the texture remains the same. There is a slight tendency to lamination which disappears with depth. The soil breaks into small subangular grains, thus affording very good tilth. The color changes through the next lower layer from reddish brown to reddish yellow, and the texture is silty clay loam. The structure is distinctly granular, with medium-sized angular grains which break apart from each other very readily. This layer is strongly columnar, the columns being small but distinct. In eroded spots where this layer is exposed the soil appears very red.

The heaviest layer occurs between depths of 26 and 60 inches. It consists of dark rich chocolate-brown silty clay loam, which becomes rich reddish brown when crushed. Although compact, this layer is fairly friable, differing in this respect from Longford silt loam which it resembles in color. The material of this layer forms columns which break into cubes about three-fourths inch in diameter. Dark organic stains are noticeable on the clay breakage surfaces. Below this layer the less weathered parent material, extending to a depth of 80 inches, consists of yellow silty clay loam mottled with brown and containing numerous small chert fragments. A few fragments of chert occur throughout the soil, but they are more numerous in this layer. In many places the different layers are thinner, and cherty limestone may be present at a depth ranging from 2 to 4 feet.

Crawford silt loam occurs in close association with Idana silt loam, Sogn silt loam, and rough stony land on the tops and slopes of the hills in that part of Clay County which is underlain by cherty limestone of Permian age. The only areas mapped are in the southern part of the county, chiefly in the neighborhood of Wakefield and in the southern part of Athelstane Township. Areas are mainly rolling or undulating and consequently are well drained. The soil erodes rather easily, but not so readily as many of the other upland soils of the county. Although it is naturally rather excessively drained, this soil withstands drought better than any other upland soil in the county with the possible exceptions of Derby silt loam and Crete silt loam. This drought-resisting quality is

owing to the friability of the compact layer, which allows adequate absorption of rainfall.

Crawford silt loam is not extensive in Clay County but is highly valued by the farmers. The crops raised are the same as on Idana silt loam, and during years when weather conditions are favorable yields are practically the same. In dry years, however, Crawford silt loam is more productive than the Idana soil because of its ability to withstand drought better. The principal crops grown are corn and alfalfa. Corn produces from 20 to 60 bushels to the acre and alfalfa from 2 to 3½ tons. A very small proportion of the Crawford silt loam is in virgin pasture. Where the slopes are steep it would doubtless be profitable to seed the land to grasses in order to check erosion.

HALL SILT LOAM

The surface soil of Hall silt loam to an average depth of 10 inches consists of very dark grayish-brown, very dark-gray, or almost black silt loam. The upper part of the surface layer is loose and silty, but the lower part is indistinctly granular. The surface soil is underlain by black heavy clay which is not granular but which when moderately dry breaks up into a mass of angular particles. Below a depth of 24 inches, the color becomes grayer or browner but the texture continues nearly as heavy as in the layer above. Below a depth of 48 inches the material is gray. Lime concretions occur abundantly in this layer to a depth of a few inches and are less numerous throughout the remainder of the layer, which extends to a depth of more than 70 inches. Small areas of the various Waukesha soils and of Hall silty clay have been included in mapping.

Hall silt loam lies on the same terrace as Waukesha silt loam but in most places in a little lower position. The heavy material seems to have been laid down in the lower part of the old flood plain near the uplands and away from the natural levees. The silty surface soil is probably the result of eluviation combined with deposition of silt by the wind.

Hall silt loam is productive when the season is sufficiently moist. Good crops of corn, alfalfa, and small grains, with small acreages of other staple crops are grown. This soil is probably more productive, on the average, than Idana silt loam but over long periods it is inferior to Waukesha silt loam.

HALL SILTY CLAY

The 6-inch surface layer of Hall silty clay consists of dark grayish-brown or black silty clay or silty clay loam having a finely granular structure. It is laminated, with a suggestion of gray silt particles between the laminæ. Between 6 and 10 inches is heavy black clay which breaks with difficulty into medium-sized angular fragments. In a freshly cut bank a columnar structure is discernible, but the columns are not apparent in an eroded bank. For the next 15 inches no important changes occur except that the soil material breaks up into larger very tenacious fragments. Between depths of 25 and 40 inches many small pockets of gypsum crystals are present.

Areas of Hall silty clay are nearly flat, and in places drainage is restricted. Nearly all the areas lie near the upland, away from the

edge of the terrace on which they occur. Most of the soil is mapped near the course of an old stream which meanders across the terrace between Morganville and Clay Center. Drainage conditions are not good, and many pools of water remain in places after rains. This is owing in part to poor underdrainage, which is caused by the extremely heavy subsoil.

Wheat, corn, alfalfa, and a few minor crops are grown on this soil. If moisture conditions could be controlled the soil would be very productive, but under present conditions it is not quite so productive as Wabash silt loam.

WABASH SILT LOAM

The 7-inch surface layer of Wabash silt loam consists of very finely granular or single-grained light grayish-brown silt loam. This is underlain to a depth of 12 inches by strongly laminated brownish-gray silt loam with gray silt particles between the laminæ. The next lower material, to a depth of 36 inches, is dark-gray silty clay loam mottled with light gray. This material is hard when dry but friable when wet. It is underlain to a considerable depth by dark-gray silty clay loam which is friable when moist.

Wabash silt loam occurs along the creeks of the county in a position intermediate between soils of the Waukesha series and the lowest bottoms. It is high enough in most places to prevent inundation at any time except during the worst floods. Judging from the lack of distinct layers, Wabash silt loam in the creek valleys is still an immature soil. The relief is the same as that of Waukesha silt loam, that is, flat with a gentle slope downstream.

This soil, which is used for the same crops as are grown on Waukesha silt loam, is almost if not quite as productive as that soil. The relief is such that the surface soil is likely to remain wet for only short periods after heavy rains, but the subsoil is so heavy that water is not very readily absorbed unless the land remains wet for a long time.

CASS SANDY LOAM

The surface soil of Cass sandy loam to a depth of about 12 inches is nearly black sandy loam containing a fairly high proportion of fine sand and showing a slight tendency to fine-granular structure. The next layer consists of light grayish-brown loamy sand 8 inches thick which also contains much fine sand and in which the numerous wormholes contain dark-colored organic material. Between depths of 20 and 40 inches the material is pale yellowish-gray loamy fine sand containing organic material in the wormholes. The next 10-inch layer is dark-brown loam, which was probably laid down under marshy conditions. In many places this dark layer is missing, and calcareous sandy material is present.

Cass sandy loam occupies positions very similar to those of Cass silty clay loam. It is somewhat less droughty, and consequently crop failures caused by dry weather are less likely to occur. It is inextensive, and its agricultural value is about the same as that of Cass silty clay loam.

CASS SILTY CLAY LOAM

The surface soil of Cass silty clay loam, to a depth of 17 inches, consists of heavy black silty clay loam which breaks into small angular particles. This heavy black surface soil tends to make the soil very droughty, the silty clay being so compact that capillary attraction is impaired. Cultivation at the proper time helps to overcome this difficulty. Between 17 and 31 inches is brown fine sandy loam streaked with dark-colored organic matter from the layer above. This dark-colored material, as a rule, follows worm and insect burrows. The next layer, which is about 11 inches thick, is highly calcareous very pale grayish-yellow very fine sand containing a few reddish-yellow iron stains. The layers between depths of 42 and 72 inches consist of interbedded strata of sand and fine sand, which are pale yellow in color streaked in places with reddish yellow. The soil material here is also highly calcareous. A few small areas of Cass loam are included with this soil in mapping.

Cass silty clay loam lies in the lower parts of the first bottoms of Republican River. In many places it apparently occupies abandoned stream and river courses which have been filled nearly to the level of the surrounding bottom lands. It may occur near the river or in proximity to the terraces or even the uplands. Owing to its occurrence in depressions, this soil is likely to remain moist for a long time after rains. However, it becomes droughty during protracted dry spells.

This soil occurs mainly in strips between areas of various members of the Sarpy series. Crops are superior to those produced on most of the other first-bottom soils, provided moisture conditions are favorable. During dry years, however, Sarpy very fine sandy loam stands drought better and consequently is valued more highly. Corn and small grains are the main crops, and yields average somewhat less than on Sarpy very fine sandy loam.

SOGN SILT LOAM

Sogn silt loam is mapped on the hillsides and around the draws which drain Idana silt loam. This is a very young soil, owing to the fact that it erodes almost as rapidly as it forms from the parent material. The surface soil, which is about 10 inches thick, is very dark grayish-brown silt loam tinged with brown. It is composed of small subangular granules. No compact layer underlies the surface soil, which grades directly into the parent material. Between depths of 10 and 30 inches the parent material consists of grayish-white friable silty clay loam streaked with gray organic matter brought down from the surface soil and spotted with reddish-yellow iron stains. In many places this layer has an olive cast. The material is strongly calcareous and grades directly into calcareous shale in some places and into limestone in others.

Most of the areas are sloping, in many places rather steeply sloping. Owing to their extremely irregular shape it is impossible to indicate them accurately on a small-scale map. As mapped they may include small strips and patches of Idana silt loam, Idana silt loam, eroded phase, Crawford silt loam, and possibly a few other soils.

Some of the Sogn silt loam is eroded to such an extent that bedrock is exposed at the surface.

The crops produced on this soil are the same as on Idana silt loam, but yields in general are less. The soil seems to be best suited to alfalfa, which is favored by the limy subsoil and whose roots tend to check erosion. One disadvantage in growing this crop is that in a very dry year it may be killed by drought. Many areas of this soil remain in pasture. This is probably the best use for the larger areas or those located on very steep hillsides. Applications of manure to increase the organic-matter content are very beneficial to this soil, as under normal conditions the organic-matter content is too meager to produce good crops for any length of time.

LADYSMITH SILT LOAM

The surface layer of Ladysmith silt loam to an average depth of about 5 inches is very dark grayish-brown or almost black heavy silt loam. A platy or laminated structure is discernible in the virgin soil, but when the material is broken up it falls apart into fine flattened granules. A sprinkling of gray or white silt occurs between the thin layers but not in sufficient quantity to change the general dark color. This layer is underlain to an average depth of 13 inches by very dark grayish-brown or black granular heavy silty clay loam, in which the granules are larger than in the layer above, ranging from one-eighth to one-fourth inch in diameter. The next lower layer is a very dark grayish-brown or black claypan. When dry the material stands up in rough imperfectly formed vertical columns which, when crushed, break up into large angular tough clods. The parent material, lying at a depth of 30 inches, consists of heavy coarsely columnar pale grayish-olive silty clay, mottled and splotched with yellowish brown on the outside of the clay particles. This material contains irregular roundish lime concretions and dark-brown or black iron concretions one-fourth inch or less in diameter. The soil between the concretions contains sufficient lime to effervesce with acid.

Ladysmith silt loam occupies flat or slightly depressed areas on the uplands at the heads of draws. It is derived from the same material as Idana silt loam and merely represents a more extreme development under conditions of more moisture. This is owing to the relief, as drainage is not so good as in the Idana soil. Many areas of Ladysmith silt loam were so small that they were included in mapped areas of Idana silt loam.

Ladysmith silt loam is not an important soil in Clay County. Agriculturally it so closely resembles Idana silt loam that a detailed description is unnecessary. In general, crop yields are somewhat greater than on the Idana soil, largely because the Ladysmith soil withstands drought a little longer. Another reason for its superior productivity is its position in areas that do not erode easily; in fact, it is more likely to receive sediment from the surrounding soils. Areas of Ladysmith silt loam are fairly evenly distributed through those parts of the county where Idana silt loam occurs.

ROUGH STONY LAND

Two kinds of rough stony land occur in Clay County but they resemble each other so closely in relief and agricultural value that they are combined on the map. The first kind consists of stony nonagricultural land in that part of the county which is underlain by limestone, and the other covers the Dakota sandstone hills in the western and northern parts of the county. Rough stony land has been left almost entirely in pasture. The material consists mainly of a surface soil of fine granular silt loam underlain at a depth ranging from 1 to 12 inches by limestone or sandstone. In many places no soil covers the rocks which protrude from the ground, especially on the hillsides. Many small areas of Idana and Lancaster silt loam are included with rough stony land in mapping. Although such areas are too small to map separately, many of them are cultivated to corn, kafir, sorghum, and other crops. Some farmers have attempted to plow the stony land and raise crops, but results have never justified the efforts expended.

The pasture grasses include big and little bluestem, buffalo grass, and grama grass. In the northern and western parts of the county where a large acreage of this rough stony land occurs, it is customary to ship in herds of cattle to utilize the pasture, and then ship them to fattening centers. Comparatively few beef cattle are raised from calves.

MEADOW

The narrow strips of soil which occur below the high-water mark along the creeks and small intermittent streams of the county have been classified as meadow. The soils of these strips is mainly dark-brown silt loam or silty clay loam, with here and there irregularly interstratified sandy material. A natural growth of elm, walnut, ash, and a few other trees is on meadow areas. In most places this soil is productive only of pasture, but in a few places, especially near the heads of streams, it can be cultivated to good advantage and very good yields of corn and the sorghums are obtained. Small grains make a rank growth on meadow and are very likely to lodge before harvest time.

DUNE SAND

In the Republican River bottom lands between Wakefield and Clifton are numerous sand dunes, most of which have been left in native grasses and are not shifting very much at present. In some places the dunes have been planted to sweetclover, which crop does very well if allowed to seed itself each year. The dunes range in height from 5 to as much as 30 feet. On the unplowed dunes the dark surface soil, which extends to a depth of about 10 inches, is underlain by incoherent sand. Where the land is plowed this sand blows badly and gradually covers the more valuable soils. In places where the land has been plowed and the surface soil blown away the only crop that will reclaim the land is sweetclover. After a growth of sweetclover has been established to hold the soil it is possible in many places to start a growth of pasture grasses which will act as a permanent cover. Between the dunes in many places are small

spots of black sandy soil which closely resembles Cass sandy loam. These spots though fertile are usually too small for economic cultivation.

The sand dunes have a hillocky relief. Most of them are situated on the first bottoms of Republican River, but a few lie on the terraces.

RIVER WASH

A few comparatively small areas classified as river wash are shown on the soil map. These areas occur either along the edge of Republican River or here and there in old courses of the river. River wash consists of loose deposits of sand, gravel, and other materials. The material differs from the Sarpy soils in its almost total lack of organic matter and in being less stable. The areas undergo change with each slight rise of the stream. The material represents the first stage of soil formation and with the gradual accumulation of organic matter will in time develop into Cass and Sarpy soils.

In a few places, where enough organic material has collected to support plant growth, crops are produced. In most places, however, the only economic use for this material is as a source of supply for sand and gravel for building purposes. At the time the survey was being made (1926) two dredges were at work digging up gravel and sand from the deposits. Some areas of river wash support a scrubby growth of willows and cottonwoods.

SUMMARY

Clay County is located north and east of the center of Kansas. It includes a total area of 652 square miles, the largest part of which is suited to agriculture.

Most of the land in the county is undulating or rolling and is, as a consequence, well drained. Comparatively small areas are too steep for successful cultivation.

The elevations of land in Clay County range from about 1,200 feet above sea level on the river bottoms to 1,500 feet in the sandstone hills of Oakland Township.

The climate of the region is generally favorable to agriculture. Rainfall is well distributed. Every few years droughts and hot winds occur, and crops are seriously damaged or entirely ruined.

The population of the county was 14,365 in 1920.

The most important crops are wheat, oats, corn, alfalfa, sorghum, kafir, Sudan grass, and prairie hay. Besides these, smaller amounts of various small grains, fruits, and vegetables are grown, chiefly for local use. Livestock raised includes dairy and beef cattle, hogs, horses, mules, poultry, and a few sheep.

The most widely distributed soil of the uplands is Idana silt loam, which gives good yields of crops. Ladysmith silt loam is very similar to the Idana soil but gives somewhat higher crop yields.

Sogn silt loam is a very young soil which lies adjacent to the Idana soils on the sides of hills. It is less productive than the Idana soils.

Lancaster silt loam is derived from weathered sandstone and has not had time to develop the heavy subsoil which characterizes the mature soils of Clay County. It is less productive than Idana silt

loam and loses its fertility more quickly than that soil. Lancaster fine sandy loam is very similar to Lancaster silt loam.

Longford silt loam is also derived from sandstone but it has been in position long enough to develop a texture profile corresponding to that of Idana silt loam. It differs from the Idana soil chiefly in color.

Crawford silt loam is considered one of the best upland soils in this part of the country. It is derived from cherty limestone.

Probably the best upland soil of the county is Crete silt loam. It is more productive than the Idana or Crawford soils and resists drought equally as well as Crawford silt loam.

Derby silt loam occurs between areas of Crete silt loam and the river bottoms. It is a very good soil but owing to excessive drainage is somewhat less productive than Crete silt loam.

Most of the bottom lands of Clay County, where sufficiently fine textured, are considered better and more productive than the upland soils.

Waukesha silt loam is one of the most productive soils in the county. It occurs on the river and other stream terraces, is well drained, has a texture allowing good capillarity, and contains a large amount of organic matter. It is easily tilled. Waukesha very fine sandy loam is nearly as productive as the silt loam member of the series and is considered superior in some respects.

Wabash silt loam resembles Waukesha silt loam. It occupies terraces a little lower than the Waukesha soils, is less perfectly drained, and contains no layer of compaction. Hall silty clay is a black extremely heavy soil which is very hard to handle except under optimum moisture conditions.

Sarpy very fine sandy loam is a first-bottom soil which ranks among the most productive soils of the county. Sarpy sandy loam is inextensive and unimportant. Sarpy loamy fine sand gives very good yields of truck crops.

Cass silty clay loam is a black soil occurring in the first bottoms. Cass sandy loam is somewhat less valuable than Cass silty clay loam.

Meadow consists of narrow strips of land made up of interbedded layers of silt, clay, fine sand, and other materials, which were laid down by flood waters along the creeks and small stream courses.

Rough stony land is mostly uncultivable land and is valuable chiefly for pasture.

River wash is mixed sand and gravel which has accumulated in the bends and on the islands of Republican River. It has no agricultural value.

Dune sand is of little value except for pasture land and for the production of sweetclover.

Clay County ranks as one of the really prosperous districts of the State of Kansas.

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[PUBLIC RESOLUTION—No. 9]

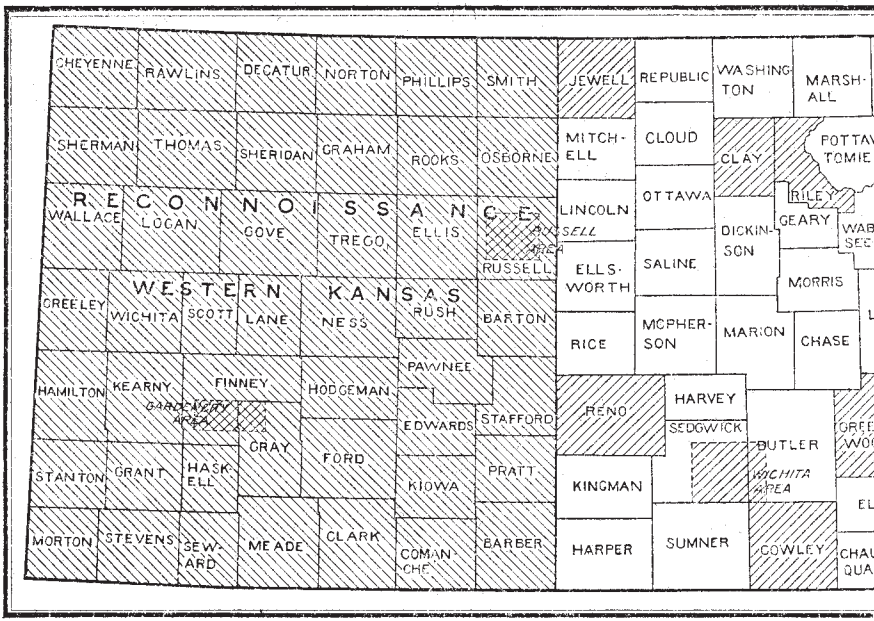
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in Kansas, shown by shading

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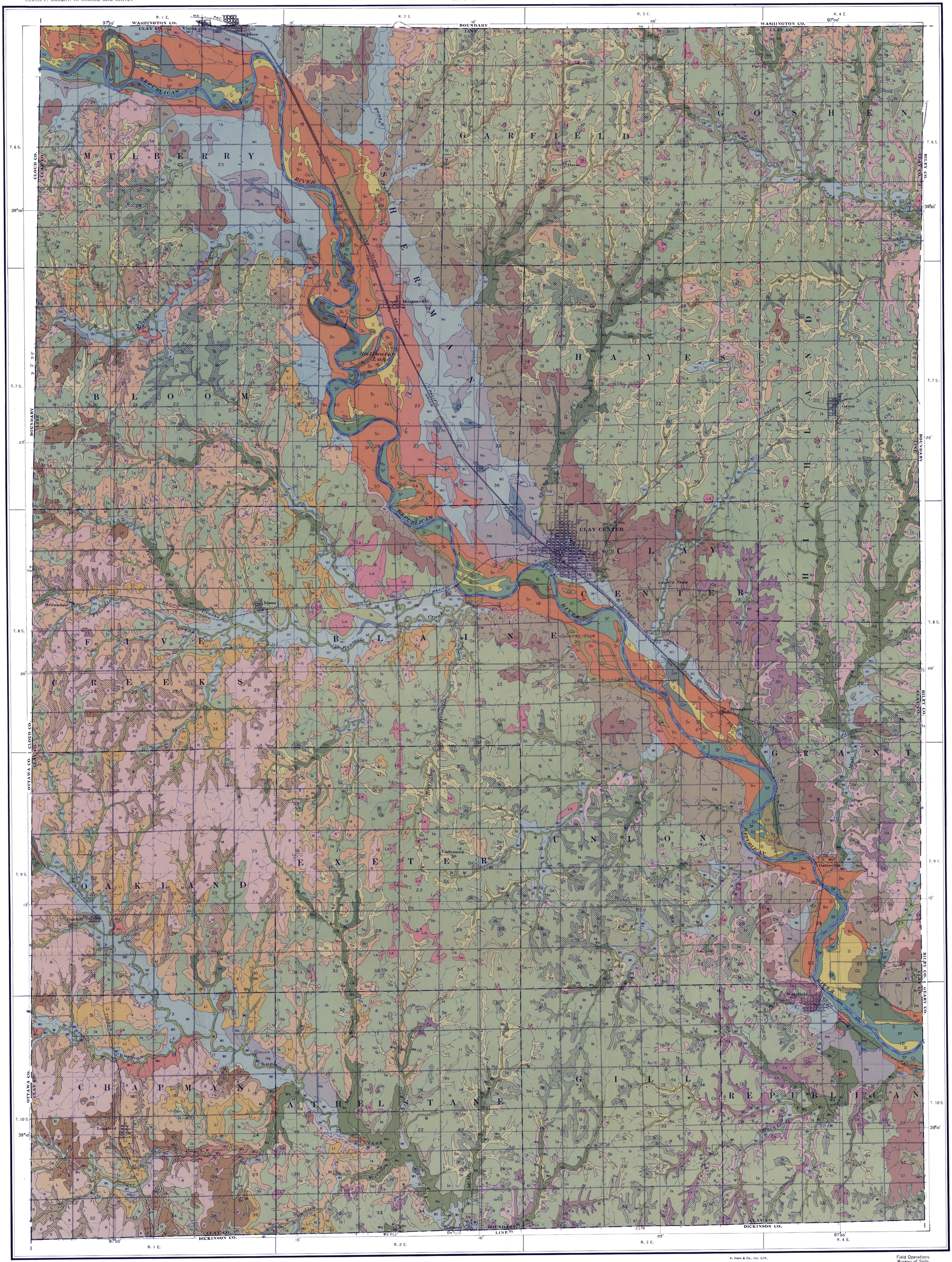
BUREAU OF CHEMISTRY AND SOILS
HENRY G. KNIGHT, CHIEF
A. G. McCALL, CHIEF, SOIL INVESTIGATIONS
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
CLAY COUNTY
KANSAS

KANSAS AGRICULTURAL EXPERIMENT STATION
L. E. CALL, DIRECTOR
R. I. THROCKMORTON, HEAD, DEPARTMENT OF AGRONOMY



LEGEND

- Cass sandy loam — Cm
- Ladysmith silt loam — Ls
- Cass silty clay loam — Cc
- Longford silt loam — Ll
- Crawford silt loam — Cs
- Sarpy loamy fine sand — Sf
- Crete silt loam — Cl
- Sarpy sandy loam — Sl
- Derby silt loam — Ds
- Sarpy very fine sandy loam — Sv
- Idana silt loam — Is
- Sogn silt loam — Ss
- Is — Eroded phase
- Wabash silt loam — Ws
- Lancaster fine sandy loam — Lf
- Hall silty clay — Hc
- Lancaster silt loam — L
- Waukesha very fine sandy loam — Wv
- L — Eroded phase
- Waukesha silt loam — Wl
- Dune sand — D
- River wash — Rv
- Meadow — M
- Rough stony land — R
- Hall silt loam — Hs

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

- City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort.
- Secondary roads and Trails
- Railroads, Steam and Electric
- Bridges, Ferry
- R.R. crossings, Tunnel
- Ford, Dam
- School or Church, Cemeteries
- Mine or Quarry, Mine dumps, Made land
- Bluff, Escarpment, Rock outcrop and Triangulation station
- Stony and Gravelly areas
- Soil boundaries
- Boundary lines
- Boundary lines
- Boundary lines
- U.S. township and section lines

RELIEF
(Printed in brown or black)

- Contours, Depression contours
- Prominent Hills, Mountain Peaks
- Sand, Wash, and Sand dunes
- Shore and Low-water line, Sandbar

DRAINAGE
(Printed in blue)

- Streams
- Lakes, Ponds, Intermittent lakes
- Intermittent streams
- Springs, Canals and Ditches, Flumes
- Swamp, Salt marshes
- Submerged marsh, Tidal flats

The above signs are in current use on the soil maps. Variations from this image appear in some maps of earlier dates.

Thomas D. Rice, Inspector, District 3.
Soils surveyed by James Thorp, U. S. Department of Agriculture, in charge, and R. H. Davis and E. S. Lyons, Kansas Agricultural Experiment Station.

Scale 1 inch=1 mile
1 ½ 0 1 2 3 4 Miles

A. Hoen & Co., Inc. Lith.

Field Operations
Bureau of Soils
1926